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Computer-Based Teaching of Pathology at the Zagreb University School of Medicine

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Aim. To review the experience gained in transferring USA computer-based teaching system of medical school pathology to Croatia.

Methods. Computer-based teaching program of pathology developed at the University of Kansas School of Medicine, Kansas City, Kansas, USA, was transferred to the University of Zagreb School of Medicine, Zagreb, Croatia. The experimental group of 49 students was enrolled into this computer-based program. Their performance was compared with that of 195 classmates enrolled in the standard course. Objective (performance on the examinations) and subjective data (students' interviews and written evaluations of the course) were analyzed.

Results. The computer program was operational 5 months from the inception of the transfer. It was well received by the students, even though many initially complained that it required more effort and a continuous commitment. The major problems concerned scheduling, reflecting various requirements imposed on students by other departments teaching in parallel with the Pathology course. Objective data gathered so far indicate that the students enrolled in the computer-based program took the first midterm examination at a significantly higher rate than the rest of the class (p<0.001), and passed the examination with significantly better grades (p<0.001).

Conclusion. Computer-based teaching programs can be readily transferred to other countries. Full implementation of the program, however, may require significant changes in the existing curriculum in the medical school to which such a program has been transferred or considerable modifications in the program adopted for transfer. It appears that the students enrolled in the computer-based program perform better than students in the standard pathology course.

Key words: computer-assisted instruction; computer programs; education, medical; pathology, examination questions; self-instructive programs, computerized; students, medical; teaching; technology transfer

The development of computer technology during the last ten years has significantly changed the approach to medical education in most medical schools in the USA and Western Europe as well as in other parts of the world (1-4). Diffusion of computer technology into developing countries is achieved through various initiatives, such as Higher Education Resource Organization (HERO) project initiated in South Africa (5) or by a number of self-instructional programs adopted for distance learning (6). The results of such technology transfer are hard to assess and quantify. Nevertheless, the prevailing views of most medical policy advisory boards are in favor of computer technology as a way of standardizing and improving medical care worldwide (7).

Computer based medical education carries the potential of establishing of “medical schools without walls” (5). However, computer technology is not inexpensive and cost-effectiveness studies of its usage have not been done. It has not been unequivocally shown that the programs developed in one country are readily usable in others. Cultural and social differences, including the priorities of health care, which dictate the health policies and structure of medical school curricula in different countries, may pose significant problems to various forms of transcultural application of systems developed for specific purposes of a country. Inherent resistance to change, local politics, and many undefined (or inadequately defined) obstacles may pose insurmountable barriers, which become apparent only upon initiation of changes dictated by technology (8).

To explore whether computer-based systems of undergraduate medical education developed in the USA could be useful for medical school teaching in other parts of the world, we have transferred to the University of Zagreb School of Medicine, Zagreb, Croatia a computer based teaching program developed over several years at the University of Kansas School of Medicine, Kansas City, Kansas. Here we report the preliminary data on the integration of this computer-based program in the teaching space of the Department of Pathology, School of Medicine, University of Zagreb, Zagreb, Croatia.
Material and Methods

Computer Based Program

The program developed at the University of Kansas School of Medicine (UKSM) over a period of two years (1994-1996) represents a slightly modified version of the teaching material originally assembled by one of the authors (ID) at Thomas Jefferson University, Jefferson Medical College, Philadelphia (PA), USA (9-12). Written in HTML with hypertext features, it can be accessed by Internet at http://www.kumc.edu.

In brief, computer program covers both general and systemic pathology in a form corresponding the standard approach to traditional US medical school curricula. The program is divided into 24 chapters, each one corresponding to a chapter in the pathology textbook (13). The material has been presented in a standardized manner so that each chapter contains an outline (table of contents) including a list of 40-50 color photographs, with legends; a list of keywords with brief explanations; and five representative clinical cases with questions for discussion and further studies. The review questions are given at the end of each chapter. Key terms from each section are interlinked with those in other sections and the pictorial material pertaining to most key terms can be readily accessed by clicking on the highlighted words.

In view of the fact that the UKSM teaching program is on the World Wide Web, our initial plan was to link it by telephone to the computers installed in the Department of Pathology at the University of Zagreb. This plan proved to be impracticable because of prohibitive cost of transatlantic telephone connection. The second major problem pertained to the fact that the United States program was in English and a relatively significant number of medical students in Zagreb are not adequately conversant in English. Thus it was decided to translate the entire program from English into Croatian and to install it onto the mainframe of the Medical School in Zagreb. The program is currently accessible from personal computers (PC). Approximately 20-25% of medical students at the University of Zagreb have personal computers at the present time but we anticipate that in not so distant future many more will use PCs to study the pathology.

Teaching Facilities

Eighteen computers were bought with the funds obtained from the Open Society. These computers were installed in a safe room at the Department of Pathology, Medical School, Zagreb. The computer room is open to students 5-8 hours per week and also during regularly scheduled seminars.

Design of the Study

The main questions addressed were:
1. Could a US generated teaching program be readily transferred to another country?
2. Will the US program change study habits of medical students in Croatia?
3. Will the students enrolled in the computer program perform better on standardized exams than their classmates who are following a lecture/seminar/microscopic study based standard program?
4. How will the students respond to an "imported" program?

In order to address these questions we have chosen at random a group of 49 students of the class of 244 students and enrolled them into the experimental computer-based program (ECBP). Statistical analysis of the students' scores from the first two years showed that they were a representative sample of the class and did not differ from the rest of the class (data not shown). An objective examination based on the material in the courses of Anatomy, Biochemistry, Histology, Physiology was given to the entire class in October 1998 to assure that indeed the sample was representative of the entire class. No statistical differences were detected in the performance of students chosen for the ECBP and the remainder of the class (data not shown).

The students in ECBP met with the instructors once a week for 4 hours. During these sessions they studied the material presented to them on the computer and participated in the discussion lead by the instructor. Weekly quizzes based on extended matching questions (11) were administered to objectively follow the students' performance. The students were also required to take monthly interim exams covering the material studied during that term. Monthly quizzes based on multiple choice questions were specifically prepared for the purpose of monthly interim exams.

The students in classic program met with the instructors 2 hours twice a week. They had weekly quizzes, but they did not have monthly interim exams. The instructors for the two groups were different. One assistant professor and two professors were involved in experimental computer based teaching. The criteria for teachers' allocations were the same as in the classic groups.

According to the rules and regulations of the Medical School, all third year students studying Pathology must take a midterm examination from February 1 until March 15. Three terms were assigned for these examinations but the students could decide which term to take. It was assumed that the "better-prepared students" will take the first term examination and those "lagging behind" the third term examination. These examinations were in the form of 120 multiple-choice questions, which
were graded electronically and evaluated according to standard psychometric methods for multiple choice examinations that calculate the means, standard deviation, and standard error of the mean for the group of students tested (10-12). The discrimination value of each question and the validity of each test were assessed by the Kuder-Richardson formula 20 (10). The performance of students in the ECBP was compared with the remainder of the class using the Wilcoxon test for non-parametric data and matched pairs test was used to observe differences between the group means. The Mann-Whitney test for unmatched data was used to look for any differences between the means of each group. Subjective evaluations were solicited from all students enrolled in the ECBP.

Results

In this preliminary study we have only fragmentary data but we feel that these are important to report since they seem to be most encouraging. The data also provide insight into an undertaking that will most likely be duplicated in other countries and our experience could be of interest to those parties. The issue of transfer of the program was addressed subjectively. Despite numerous difficulties, the program was installed and is currently used by students. To this end no additional comments are needed, except to emphasize that a concentrated effort and dedication will pay off.

Monitoring of students with weekly quizzes, monthly tests, and subjective evaluation by teachers showed that more than 80% of all students enrolled into ECBP were constantly studying. The students prepared for the computer based sessions, actively participated in the discussion, and made obvious progress in mastery of the material. The fact that 71% of all students in the ECBP chose to take the first term (compared with 15% of the rest of the class, p<0.001) also indicates that the attendance of the ECBP has had a profound beneficial effect on students' study habits (Table 1).

Table 1. Test results of a midterm exam for students in classic program and those in experimental computer-based program

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<th>Classic Program</th>
<th>Experimental Computer-based Program</th>
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<tr>
<td>Highest grade (%)</td>
<td>85</td>
<td>90</td>
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<tr>
<td>Lowest grade (%)</td>
<td>65</td>
<td>75</td>
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The results on the midterm exam also show that the ECBP students performed better than their classmates taking the standard course. The passing grades of ECBP students were significantly higher (Fig. 1).

The computer course was initially accepted with great enthusiasm. As the time passed and the students enrolled in the ECBP realized that they have to study more and be prepared for sessions on a weekly basis, the "enthusiasm" decreased. Nevertheless, after 6 months of the ECBP, most students felt that this was a better way of studying Pathology than the standard course. All of them (100%) responded positively to the question "If you had the choice would you enroll again into a computer based program?" The students also had numerous critical remarks intended to improve the course next year, e.g., some of critical remarks were duration of each course (4 hours), poor quality of some pictures, standard manual projections of the slides instead of video projections, etc. – an indication of their active involvement in the educational program.

Discussion

In this preliminary report we analyzed the objective data gathered in the process of installing USA generated teaching system in Croatia. This interim progress report reflects our obvious enthusiasm for the project, which, despite numerous difficulties, proved to be an unmitigated success from more than one point of view. Among other things, we were able to show that technology transfer can be accomplished with relative ease as long as there is commitment and good will among the faculty and support from the University. The investment into the program was substantial, but not prohibitive. Private funding was an important part of the progress which otherwise could not have been initiated. The investment has already given results, which can be measured both objectively and subjectively. Finally, it is important to note that such a program could serve as the nucleus for more extensive changes and the restructuring of teaching in the entire Medical School as well in other university centers in Croatia.

At the present time it is not possible to determine whether the computer based learning system has had a quantifiable impact on the scholastic performance of students enrolled in this program. Long-term studies are planned to this end, the preliminary data are, however, encouraging. The overall
impression of the instructors teaching the ECBP groups was that the students were better prepared for the seminars than those in the standard curriculum; the students were more inclined to take the exams in the first term; and the overall grades of the students in the ECBP were significantly better than those of their classmates. The final analysis of the program will be published once the final grades for the entire course are collated by the end of October of 1999, and the grades for the entire course are compiled.

Despite the more "rigidly controlled" teaching system in ECBP we do believe that the program alone and the possibilities of computer based teaching influenced the better grades in ECBP. The striking bimodality in ECBP group is additional indicator, meaning that those students with sufficient and good grades would be those who would most probably not even attempt to take midterm exam. Some time will pass until the value of computers in medical education has not been fully assessed in general (14-16). This report is a testimony that the enthusiasm for the computer based learning is as fervent in Croatia as in other countries. Both the students and the instructors found this experience rewarding. The medical educators and the students seem to be enthusiastic about this new technology even though computers are not a panacea and should not be expected to solve all the problems. But they are certainly an impetus to improve medical education and develop good working habits, and a foundation for life long continuous education among students.

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References

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